

The protolith nature of diamondiferous metamorphic rocks of the Kokchetav Massif

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Ultra-high-pressure diamondiferous rocks (UHP) of the Kokchetav subduction-collision zone are considered as an ideal object for studying the mobility of elements in subduction zones of the continental type. The compositional diversity of metasedimentary rocks subjected to UHP metamorphism makes it difficult to establish the nature of their protoliths. This, in turn, complicates estimates of the degree of depletion of the UHP metamorphic rocks relative to the protoliths.

To clarify the nature of protholiths of the Kokchetav diamondiferous rocks we studied the geochemical features and Sm-Nd isotopic composition of diamondiferous calc-silicate, garnet-pyroxene rocks, high-alumina metapelites and barren granite-gneisses.

The nine samples of the Kumdy Kol microdiamond deposit (one granite-gneiss, 4- calc-silicate rocks, 3- garnet-pyroxenite) yielded a Sm-Nd whole-rock isochron age of 1052 ± 44 Ma. This age is close to the age of formation of the granitic gneiss basement of the Kokchetav massif (1.2-1.05 Ga) (Glorie et al., 2015). Therefore, we assume that the protoliths of these rocks were basement rocks. In this interpretation, their geochemical features may not be directly related to the processes of ultrahigh-pressure metamorphism.

At the same time, the high-alumina rocks of the Barchinsky area are depleted to different degrees with respect to LREE and K yielded a whole-rock isochron with an age of 509 ± 32 Ma, which suggests partial melting of these rocks during the exhumation stage.

It was previously assumed that metasedimentary rocks of the Kokchetav microcontinent are the protoliths of diamondiferous rocks (Buslov et al., 2015). However, this contradicts with Sm-Nd isotopic data for metasedimentary rocks of quartzite-schist sequences of the Kokchetav microcontinent (Kovach et al., 2017). The metasedimentary rocks of the Sharyk Formation are characterized by variations in the $\epsilon_{Nd(t)}$ from +4.1 to -3.3 and in $t_{Nd(DM)}$ from 1.9 to 1.25 Ga, whereas in the UHP metamorphic rocks $\epsilon_{Nd(t)}$ varies from -7.6 to -13.2, and the model ages range from 2.7 to 2.3 Ga. These data clearly indicate that the metasedimentary rocks of the Kokchetav massif could not be the protolith of the ultrahigh-pressure rocks.

References

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